REMARKS

This amendment is responsive to the Non-Final Office Action mailed on November 12, 2008. Claims 1, 3-5, 7-10, 13 and 15-19 stand rejected. Claims 1, 10, and 13 have been amended. Claims 20-24 are new. In view of the following remarks, Applicant respectfully submits that this application is in complete condition for allowance and requests reconsideration of the application in this regard.

Rejections under 35 USC § 101

The Examiner has rejected claims 1, 3-5, 7-10, 13 and 15-19 under 35 U.S.C. §101 as being directed to non-statutory subject matter. Of these claims, claims 1, 10, and 13 are the independent claims. Claims 1, 10, and 13 have all been similarly amended to include a computer of the type including a database management system (shown in FIGs. 1 and 2, and supported at page 10, line 19 – page 14, line 2, of Applicant's specification). The claims have been further amended to recite that the method steps are performed in the computer. Therefore Applicant believes that amended claims 1, 10, and 13, and claims 3-5, 7-9, and 15-19 which depend therefrom, are properly directed toward statutory subject matter. Thus, Applicant respectfully requests the § 101 rejections for claims 1, 3-5, 7-10, 13, and 15-19 be withdrawn. New independent claims 20 and 22 are program product[1] versions and new independent claim 24 is an apparatus version of independent method claims 10, 13, and 1 respectively. Independent claims 20, 22, and 24 also incorporate, at least in part, the subject matter of amended independent claims 10, 13 and 1 respectively, and are thus allowable for at least the same reasons as independent claims 1, 10 and 13.

Rejections under 35 USC § 103

The Examiner has rejected claims 1, 3-5, 9, 10, 13, 15, 18 and 19 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,757,677 to Pham et al. (*Pham*) in view of U.S. Patent No. 6,662,175 to Ghazal et al. (*Ghazal*) and further in view of the "Bulletin of the Technical Committee on Data Engineering" (*Data Engineering*). *Pham* is directed to

[1] The Examiner will note that independent claims 20 and 22 recite at least in part "a recordable computer readable medium" upon which the program code is stored, and that the program code performs the recited functions "upon execution." Support for these claims may be found, for example, on pages 11-12 of the application as filed. Applicant respectfully submits that these claims are likewise directed towards statutory subject matter.

performing a join of multiple tables in response to receiving a query containing WHERE and GROUP BY clauses. The join is performed by reducing the number of active rows of at least one of the tables to be joined prior to performing the join operation. The passage of *Ghazal* cited by the Examiner (col. 3, lines 9-36) briefly discloses a query containing at least one of a WHERE clause and a GROUP BY clause and then proceeds to define the function of the GROUP BY and WHERE clauses. *Data Engineering* generally discusses the evolution of query optimization with a section discussing query transformation. This section generally discusses transformations such as distributing NOT predicates where appropriate, bounding LIKE predicates, converting disjuncts to conjuncts with DeMorgan's law, and in the section cited by the Examiner, generating additional equality predicates using transitive closure of equality predicates.

With respect to claim 1, on page 4 of the Office Action, the Examiner states that while *Pham* discloses a query with at least one search condition (WHERE clause), *Pham* fails to disclose the further limitations of applying transitive closure analysis to at least one search condition in the query, rewriting the criteria to generate modified criteria to reduce the number of tables being referenced, and based on the transitive closure analysis, substituting the equivalent field for the field referenced in the criteria to generate modified criteria that references only one table. The Examiner contends that these deficiencies are supplied by *Ghazal*. The Examiner contends that *Ghazal* allegedly discloses query optimization applying transitive closure to a search condition in the query to identify an equivalent field for the field referenced in the criterion, citing Ghazal col. 1, lines 7-9 and 22-26. The Examiner further contends that *Ghazal* allegedly discloses that based on the transitive closure analysis, the criteria is rewritten to generate modified criteria to reduce the number of tables referenced by substituting the equivalent field for the reference field in the criteria to generate modified criteria at col. 1, lines 37-38. The Examiner then admits that *Ghazal* actually discloses referencing only one row at col. 1, lines 27-28 and fails to disclose referencing only one table. Furthermore, the Examiner makes a conclusory statement that it would have been obvious to apply the concept of referencing only one row in order to reference only one table. However, one of ordinary skill in the art would know that there is a substantial difference between referencing rows of table and referencing tables generally. Moreover the Examiner has failed to provide any rationale for this statement except that "One would have been motivated to do so since this is the basic purpose of query

rewrite." (Office Action pg. 5) Yet, the Examiner has failed to show the link between rewriting queries and referencing only one table. One of ordinary skill in the art knows that query optimizers frequently rewrite queries in order to reduce the time and resources required to perform the query without necessarily reducing multi-table queries to a single table. It is only with hindsight and the benefit of Applicant's disclosure that the Examiner could assert this motivation.

Moreover, as set forth in the previous response, *Ghazal* contains two occurrences of the term transitive closure. The first occurrence is in the passage cited by the Examiner in the background of the disclosure. Here *Ghazal* merely states that transitive closure is one of a number of syntactic or algebraic transformations that may be used for query transformation. However this passage gives no further details to how one of ordinary skill in the art would use any of the disclosed syntactic or algebraic transformations to assist the query optimizer in performing query transformations. This passage certainly fails to disclose or even suggest applying transitive closure analysis to at least one search condition in the query to identify an equivalent field referenced in the criteria and using the analysis to rewrite the criteria to reduce the number of tables referenced thereby.

The second occurrence of the term transitive closure can be found in *Ghazal* at col. 5 line 57- col. 6 line 8. This passage discusses performing a transitive closure of the WHERE-clause conditions to calculate new date constraints which could reduce the size of the intermediate result that is generated. This passage also fails to disclose or suggest using transitive closure analysis to rewrite the criteria to reduce the number of tables referenced in a query. Moreover, *Ghazal* fails to disclose or suggest "applying transitive closure analysis to at least one search condition in the query [having a GROUP BY or ORDER BY clause] to identify an equivalent field for a field reference in the criteria" and "based on the transitive closure analysis, rewriting the criteria to generate modified criteria to reduce the number of tables referenced thereby" anywhere in the reference.

Further on page 5 of the Office Action, the Examiner states that it would have been obvious to one of ordinary skill in the art to apply the transitive closure disclosed in *Ghazal* to optimize the query of *Pham*. The Examiner states that one would have been motivated to do so since it is well known that query optimization improves overall performance which reduces resource utilization. However, even if the transitive closure techniques disclosed in *Ghazal* with

respect to WHERE clauses were applied to the GROUP BY operation of *Pham*, one of ordinary skill in the art would use the transitive closure analysis to assist in reducing the number of rows prior to a join operation as disclosed in *Pham*. Again, it is only through hindsight and the benefit of Applicant's disclosure that the Examiner is able to assert that one skilled in the art would use the transitive closure analysis in *Ghazal* in *Pham* to "rewrit[e] the criteria to generate modified criteria to reduce the number of tables referenced thereby by substituting the equivalent field for the field referenced in the criteria" as recited in Applicant's claim 1, when there is no teachings or suggestions in either reference to reduce the number of tables. Rather both references teach reducing the table sizes prior to a join operation.

The Examiner recognizes this by admitting on page 5 of the Office Action that the combination of *Pham* and *Ghazal* fails to explicitly disclose that the transitive closure reduced the number of tables referenced, which is consistent with Applicant's arguments above. The Examiner contends that *Data Engineering* allegedly discloses the concept of using transitive closure on both single-table and join predicates, including applying transitive closure to reduce the number of tables referenced on page 7, lines 17-23. The Examiner's interpretation of this passage, however, is flawed. The passage referred to by the Examiner begins by stating that, "DB2 for MVS generates the transitive closure of equality predicates, for both single-table and join predicates, to allow earlier filtration of rows and more potential join sequences." (emphasis added). This passage fails to disclose reducing the number of tables. Further, the Examiner points to the join example, which illustrates that "join predicates of T1.C1=T2.C2 AND T2.C2=T3.C3 will cause DB2 to generate T1.C1=T3.C3." The Examiner leaps to the conclusion that this is a reduction of the number of tables even though the remainder of the statement points out that "without [generating the T1.C1=T3.C3 predicate] the join enumerator would have deferred considering a join between T1 and T3." This passage illustrates that with the use of transitive closure, the join of the T1 and T3 tables can be performed earlier than if no transitive closure were performed. Therefore, *Data Engineering* also fails to disclose "rewriting the criteria to generate modified criteria to reduce the number of tables referenced thereby" as recited in Applicant's claim 1. Rather, *Data Engineering* discloses generation of additional predicates to "allow earlier filtration of rows and more potential join sequences." Further, the passage concludes that "[w]hen there are more than a preset number of tables in a join, join predicate transitive closure is not performed in order to keep the search space of the dynamic

programming join enumeration strategy in check." (emphasis added). In addition to failing to disclose using transitive closure to reduce the number of tables, *Data Engineering* further discourages using transitive closure when a preset number of tables is exceeded.

Furthermore, none of the references disclose transitive closure being used with a GROUP BY or an ORDER BY clause. *Pham* discloses a GROUP BY statement but fails to disclose transitive closure. *Ghazal* uses transitive closure with a WHERE clause, not a GROUP BY or ORDER BY clause. *Data Engineering* uses transitive closure with a JOIN clause. Thus *Ghazal* and *Data Engineering* do not consider some of the challenges of using GROUP BY and ORDER BY clauses as set forth in the background of Applicant's specification. Applicant submits that it is only through hindsight and the benefit of Applicant's disclosure that the Examiner could assert using the transitive closure techniques in *Ghazal* and/or *Data Engineering* (which have only been used with JOIN or WHERE clauses) with the GROUP BY clause in *Pham*. Moreover the Examiner has provided no additional information or citations in the disclosures directed to how transitive closure could be used with a GROUP BY or ORDER BY clause. The Examiner merely provides a conclusory statement based on the combination.

Therefore, Applicant submits that the Examiner has failed to establish a prima facie case of obviousness and Applicant's independent claim 1 is patentable over the combination of *Pham*, *Ghazal*, and *Data Engineering*. Consequently, Applicant respectfully requests that the rejection of claim 1 be withdrawn.

The Examiner has rejected dependent claims 3-5, and 9 as also being unpatentable over *Pham*, *Ghazal*, and *Data Engineering*. These claims depend from independent claim 1 and are patentable over *Pham*, *Ghazal*, and *Data Engineering* for at least the same reasons set forth above. Furthermore, these dependent claims recite unique combinations of elements not disclosed or suggested by *Pham*, *Ghazal*, and *Data Engineering*. Therefore, Applicant respectfully requests that the rejections of claims 3-5 and 9 be withdrawn. Additionally, new claim 24 is an apparatus version of independent claim 1 and is patentable for the same reasons set forth above.

The Examiner has rejected independent claim 10 as being unpatentable over *Pham*, *Ghazal*, and *Data Engineering*. Similar to the rejection of claim 1, the Examiner states that *Pham* fails to disclose generating a modified criteria using transitive closure analysis by substituting the equivalent field for the field references in the criteria, wherein the criteria

references a plurality of tables and the modified criteria references a single table. The Examiner then states on page 6 of the Office Action that "while *Ghazal* discloses referencing only one row, *Ghazal* fails to disclose referencing only one table." The Examiner further states that it would have been obvious to one of ordinary skill in the art to apply the concept of referencing only one row in order to reference only one table and one would be motivated to do so since this is the basic purpose of query rewrite. However, one of ordinary skill in the art would know that there is a substantial difference between referencing rows of table and referencing tables generally and it is only with the use of hindsight that the Examiner could make such an assertion. Moreover, as set forth above, neither *Pham* nor *Ghazal* disclose or suggest using transitive closure analysis to rewrite query criteria that references multiple tables to reference a single table and that it is only through hindsight and the benefit of Applicant's disclosure that the Examiner can make these assertions. The Examiner then similarly asserts that *Data Engineering* discloses the missing elements. But as set forth above, *Data Engineering* also fails to disclose rewriting query criteria that references multiple tables to reference a single table. Therefore, for the same or similar reasons as set forth with respect to independent claim 1, independent claim 10 is also patentable over *Pham*, *Ghazal*, and *Data Engineering* and Applicant respectfully requests that the rejection for claim 10 be withdrawn. Additionally, new claim 20 is a program product version of claim 10 and is patentable for the same reasons set forth above. New claim 21 depends from claim 20 and is also patentable.

The Examiner has rejected independent claim 13 as being unpatentable over *Pham*, *Ghazal*, and *Data Engineering*. The Examiner states on pages 8-9 of the Office Action that *Ghazal* discloses query optimization including the further limitations of applying transitive closure analysis to a plurality of search conditions in the query to determine a subset of equivalent fields and rewriting a criteria to generate a set of respective modified criteria that each reference one more equivalent search fields in col. 1 lines 7-9 and 22-36, which is not disclosed in *Pham*. The Examiner additionally states that *Ghazal* discloses selecting join order from among a plurality of join orders for the plurality of join operations using at least one of the set of respective modified criteria at col. 1, lines 37-38, which is also not disclosed in *Pham*.

As set forth above with respect to claim 1, col. 1 of *Ghazal* fails to disclose applying transitive closure to a plurality of search conditions. The background of *Ghazal* merely lists transitive closure as one of a number of techniques used by query optimizers with no further

teachings of how they are used. Further, lines 37-38 of *Ghazal* disclose, "The basic purpose of a query rewrite is to reduce the number of rows processed during the query." (emphasis added). Nowhere in this passage does *Ghazal* disclose selecting join order from among a plurality of join operations as contended by the Examiner. Furthermore as set for the above, *Ghazal* discloses using transitive closure analysis to reduce the size of an intermediate result at col. 5, line 56 – col. 6 line 17. However, *Ghazal* fails to disclose applying the analysis to a plurality of search conditions, much less selecting a join order from among a plurality of join orders for the plurality of join operations using at least one of the set of respective criteria modified by the transitive closure analysis.

Moreover, the Examiner admits that *Pham* and *Ghazal* fail to explicitly disclose the transitive closure being used to reduce the number of tables and as above asserts that *Data Engineering* remedies the deficiency. But as established above in relation to claim 1, *Data Engineering* also fails to disclose rewriting query criteria that references multiple tables to reference a single table. Therefore the combination of *Pham*, *Ghazal*, and *Data Engineering* fail to disclose all of the elements of Applicant's claim 13. Furthermore, the Examiner has provided no motivation to modify the combination of *Pham*, *Ghazal*, and *Data Engineering* to contain the elements of Applicant's claim 13. The Examiner merely makes a generalized statement that query optimization improves overall performance which reduces resource utilization. For these reasons, Applicant submits that independent claim 13 is patentable over *Pham*, *Ghazal*, and *Data Engineering* and respectfully requests that the rejection for claim 13 be withdrawn.

The Examiner has rejected dependent claims 15, and 18-19 as also being unpatentable over *Pham*, *Ghazal*, and *Data Engineering*. These claims depend from independent claim 13 and are patentable over *Pham*, *Ghazal*, and *Data Engineering* for at least the same reasons set forth above. Furthermore, these dependent claims recite unique combinations of elements not disclosed or suggested by *Pham*, *Ghazal*, and *Data Engineering*. Therefore, Applicant respectfully requests that the rejections of claims 15, and 18-19 be withdrawn. Additionally, new claim 22 is a program product version of claim 13 and is patentable for the same reasons set forth above. New claim 23 depends from claim 22 and is also patentable.

The Examiner has rejected claims 7-8 and 16-17 under 35 U.S.C. § 103(a) as being unpatentable over *Pham* in view of *Ghazal* in view of *Data Engineering* and further in view of U.S. Patent No. 5,598,559 to Chaudhuri (*Chaudhuri*). *Chaudhuri* is directed to an

optimization technique for a query having a GROUP BY clause. The optimization technique generates execution plans, which places the GROUP BY preceding every internal join node. The optimizer then estimates the cost of each of these execution plans and selects the plan having the lowest estimated cost. With respect to dependent claims 7 and 8, the Examiner contends that *Chaudhuri* discloses building indices over columns at col. 7, line 55 – col. 8, line 26. In this passage, *Chaudhuri* discloses a relation index which is used to optimize the sub-queries within a query containing at least one join. This passage fails to disclose building an index over a column. Furthermore, there is no disclosure in *Chaudhuri* to remedy the deficiencies of *Pham*, *Ghazal*, and *Data Engineering* identified above with respect to the rejection of independent claim 1, from which these claims depend. For these reasons, Applicant respectfully requests that the rejections of dependent claims 7 and 8 be withdrawn.

With respect to dependent claims 16 and 17, these claims depend from independent claim 13. As set forth above, *Chaudhuri* fails to remedy the deficiencies of *Pham*, *Ghazal*, and *Data Engineering*, and therefore for the same or similar reasons set forth above, Applicants submit that dependent claims 16 and 17 are also patentable and respectfully request that the rejections for these claims should be withdrawn.

Conclusion

Applicant has made a bona fide effort to respond to each and every requirement set forth in the Office Action. In view of the foregoing amendments to the claims and remarks given herein, Applicant respectfully believes this case is in condition for allowance and respectfully requests allowance of the pending claims. If the Examiner believes any detailed language of the claims requires further discussion, the Examiner is respectfully asked to telephone the undersigned attorney so that the matter may be promptly resolved. The Examiner's prompt attention to this matter is appreciated.

Applicant is of the opinion that no additional fee is due as a result of this Amendment. Payment of all charges due for this filing is made on the attached Electronic Fee Sheet. If any additional charges or credits are necessary to complete this communication, please apply them to Deposit Account No. 23-3000.

Respectfully submitted,

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Date

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